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Catalogue of Points on the Moon's Surface whose position has been recently determined by Micrometrical Measures. By E. Neison.

Those who have devoted attention to astronomical questions in connection with the Moon have long recognised the necessity of the completion of the system of measured points on the lunar surface. In especial, for the adequate mapping of the lunar surface, it is essential that the present mere skeleton of a system of measured points should be properly filled in by the determination from micrometrical measures of the position of a requisite number of new points.

Lohrmann was the first to attempt to form such a system, and from 150 good measures he ascertained the position of 21 points, though five of these, resting on fewer than five measures, were merely approximations.

It is however to Mädler that the real commencement of this work must be ascribed, as Lohrmann's results were too partial to be regarded as being properly such. From 784 measures* Mädler determined the places of 85 new points on the lunar surface, besides increasing the accuracy of seven of Lohrmann's places by additional measures, numbering in all 31. By uniting Lohrmann's measures with his own, Mädler obtained a series of 105 points whose places had been determined with some accuracy, and resting mainly on from eight to eleven measures.

Since 1832, however, nothing further has been done with a view of completing this work, though this has always been recognised as desirable. It is true Mädler subsequently made a few measures to determine the place of the north pole of the Moon, and Bessel and Wichmann ascertained the place of Mösting A: these were made, however for different and special purposes.

In its present condition, the system of measured points on the lunar surface is entirely inadequate; and, with the exception of Manilius and Mösting A, the places of the points have not been determined with sufficient accuracy for several important purposes. But though Bessel, Encke, and Mädler have urged the desirability of obtaining additional determinations, and the British Association appealed for further results, no attempt until now appears to have been made to complete the work left by Mädler in 1832.

As the subject appeared pressing, and (selenographically at least) of the highest importance, in 1873 it was determined to undertake as far as possible the extension of the present series of measured points. For this purpose, during 1874 and 1875,

* Mädler made 919 measures, but 104 were subsequently rejected as discordant, or for other reasons.

numerous measures were obtained whenever possible, employing a modified method, and using a somewhat more convenient system of reduction than Mädler's. This method was framed with a view of admitting of the introduction, at any subsequent time, of a correction for the effects of any real libration.

On the basis of these measures the following Catalogue has been founded, and rests on the results of 340 sets of measures, each consisting of five separate results. The Catalogue consists of the name of the point, the longitude and latitude found, and the number of measures these are based on. The designation of Beer and Mädler for the same, together with the place previously assigned to the point, are also added, as well as the name of the authority for this place. In the column giving the class of measures, 1st stands for points of the First Order, and 2nd for points of the Second Order, using Mädler's classification. The first are measured from the limb by the method of Encke, and the latter from one of these last, by a measure with a position micrometer. These latter are of course in a very marked degree inferior in point of accuracy to the first. In the column of authorities, L stands for Lohrmann, M for Mädler, and W for Wichmann.

The Catalogue comprises 35 points in all, and includes four whose places had previously been determined with some accuracy by Lohrmann, and four others whose position had been fixed still more satisfactorily by Mädler. Those eight points enable a comparison to be made between these new measures and those of Lohrmann and Mädler. The remaining points have been selected mainly for the purpose of fixing accurately the position of the lunar equator and first meridian, or else to fill the most important gap in the system of Beer and Mädler, or, finally, for some analogous special point, mainly directed with a view to the requirements of a new investigation into the real libration of the Moon.

The series taken in unison with the results given by Mädler in the *Der Mond*, establish with a very considerable accuracy the position of the points—Gassendi, Kepler, Landsberg, Bode, Lalande, Murchison A., and Hipparchus C. Taken together with the results obtained by Nicollet for Manilius and Wichmann for Mösting A., they will enable the exact position of the lunar equator and selenographical first meridian to be ascertained with some precision.

Catalogue of Points on the Surface of the Moon, whose Positions have been Determined from Micrometrical Measures, during 1874-1875.

Name	No. of Observations.	Position from Recent Measures.		Beer and Mädler's Designation.	Class of Measures.	No. of Measures.	Position from Previous Measures.		Authority.
		Longitude.	Latitude.				Longitude.	Latitude.	
		° ' "	° ' "				° ' "	° ' "	
Agrippa	3	10 4 17 W.	3 55 20 N.	Agrippa	1st	9	10 22 13 W.	4 4 16 N.	L.
(a) Archimedes A 17		7 10 47 E.	27 44 58 N.	Archimedes A	2nd	1	6 31 E.	27 56 N.	M.
(b) Bessarion 11		37 0 41 E.	14 58 48 N.	Bessarion ?	2nd	1	37 5 E.	14 37 N.	M.
Bessel 7		17 22 26 W.	21 54 14 N.	Bessel	2nd	1	17 37 W.	21 43 N.	M.
Bode 28		2 39 21 E.	6 37 55 N.	Bode	1st	6	2 30 48 E.	6 37 54 N.	L.
Bode A 6		1 19 40 E.	8 53 57 N.	Bode A	2nd	1	1 16 E.	8 56 N.	M.
Bode B 6		3 9 41 E.	8 42 20 N.	Bode B	2nd	1	3 0 E.	8 23 N.	M.
Bohenberger A 4		39 24 10 W.	17 3 8 S.	Bohenberger a		Estimated	39 10 W.	17 4 S.	M.
Brayley 5		36 25 10 E.	20 53 52 N.	Euler A	2nd	1	36 36 E.	20 46 N.	M.
Encke 7		36 35 35 E.	4 18 14 N.	Encke		Estimated	36 40 E.	3 40 N.	M.
Encke B 8		36 18 56 E.	1 57 6 N.	Encke b		Estimated	36 20 E.	1 30 N.	M.
Eratosthenes 7		11 41 19 E.	14 23 58 N.	Eratosthenes	1st	6	11 26 22 E.	14 26 35 N.	L.
(c) Gassendi 10		39 30 6 E.	17 0 48 S.	Gassendi A	1st	9	39 31 37 E.	16 55 40 S.	M.
Guerike C 8		11 43 37 E.	11 48 53 S.	Guerike C	2nd	1	11 39 E.	11 13 S.	M.

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		Longitude.	Latitude.				Longitude.	Latitude.	
		° ' "	° ' "				° ' "	° ' "	
Hipparchus C	18	8 3 34 W.	7 22 27 S.	Hipparchus c	2nd	I	8 18 W.	7 19 S.	M.
(d) Hortensius	12	27 41 8 E.	6 2 8 N.	Hortensius	2nd	I	27 52 E.	6 56 N.	M.
(e) Kepler	14	37 38 58 E.	7 57 48 N.	Kepler	1st	II	37 42 18 E.	7 46 13 N.	M.
Lalande	17	8 47 41 E.	4 26 34 S.	Lalande	1st	6	8 44 23 E.	4 20 3 S.	L.
Landsberg	9	26 18 49 E.	0 25 28 S.	Landsberg	1st	10	26 33 49 E.	0 29 51 S.	M.
Landsberg A	8	31 5 26 E.	0 2 20 N.	Landsberg A	2nd	I	30 43 E.	0 5 S.	M.
Mädler	5	29 11 58 W.	10 55 59 S.	Theophilus A	2nd	I	29 34 W.	10 58 S.	M.
Marius	2	49 57 5 E.	11 58 44 N.	Marius	2nd	I	50 27 E.	11 27 N.	M.
Menelaus	11	15 31 2 W.	16 24 17 N.	Menelaus	2nd	I	15 46 W.	16 13 N.	M.
Milichius	11	29 40 1 E.	10 0 15 N.	Milichius	2nd	I	29 57 E.	10 20 N.	M.
Mösting	6	5 53 2 E.	0 36 26 S.	Mösting	2nd	I	5 54 E.	0 38 S.	M.
Mösting A	24	5 13 56 E.	3 10 25 S.	Mösting A	1st	50	5 13 23 E.	3 10 55 S.	W.
Murchison A	18	1 0 4 W.	4 3 57 N.	Triesnecker A	2nd	I	1 6 W.	3 57 N.	M.
Proclus	6	46 28 24 W.	16 12 8 N.	Proclus	1st	9	46 31 34 W.	16 9 8 N.	M.
Ptolemaus A	10	0 58 22 E.	8 34 58 S.	Ptolemaus A	2nd	I	0 44 E.	8 56 S.	M.
Reinhold	10	22 37 26 E.	3 13 19 N.	Reinhold	2nd	I	22 36 E.	3 4 N.	M.
(f) Rosse	8	34 19 38 W.	17 48 37 S.	Fracastorus E	2nd	I	33 41 W.	17 27 S.	M.
Ukert	11	1 9 10 W.	7 48 24 N.	Ukert	2nd	I	1 26 W.	7 33 N.	M.
Wichmann	4	37 56 13 E.	7 41 15 S.	Euclides a		Estimated	37 35 E.	7 50 S.	M.

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Points on the Moon's Surface.

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With regard to these results, the following Notes seem desirable:

a. (Archimedes A.) There is a very considerable discrepancy between the place of this crater as given by Mädler and as found by these later measures; and this difference appears to be too large to be due merely to errors incidental to the process adopted by Mädler in making his measures of the 2nd order. In the *Der Mond* the symbol for the point measured is not given, but in the map the crater A alone answers to the description, though it is placed in only $6^{\circ} 22'$ E longitude, the latitude being the same. Mädler's place appears to be, however, undoubtedly wrong. From measures that have been made it would appear, in fact, that not only is the crater A placed too near Archimedes, but that this last great walled plain is too far west.

The measures on which the position of this point rest were made in two separate series, divided by a period of four months, and are:

1st Archimedes A. 8 measures. $7^{\circ} 7' 52''$ E. Long. $27^{\circ} 46' 48''$ W. Lat.

2nd Archimedes A. 9 measures. $7^{\circ} 13' 23''$ E. Long. $27^{\circ} 42' 53''$ W. Lat.

These results are therefore very fairly accordant, though some of the separate results exhibit peculiar differences, analogous to similar features presented in some of Mädler's series.

b. (Bessarion.) Some uncertainty attaches to the identity of this point. Mädler describes Bessarion in the *Der Mond* as a 6° bright crater, with, on its north, a light spot containing a small brighter crater in $37^{\circ} 5'$ E longitude and $14^{\circ} 37'$ N latitude, and his map agrees with this description. On the Moon, however, Bessarion under high illumination appears to occupy the centre of an elliptical bright spot, and the centre of this spot has been measured. No favourable opportunity has yet occurred to enable the exact relation of this elliptical white spot to the ringplain Bessarion to be ascertained.

c. (Gassendi). The glittering 7° bright point towards the centre of Gassendi, measured by Mädler, was considered by him to be a point about five miles north of the principal centre peak, and not to be a central elevation. This does not appear to be exact, and this 7° bright point seems to be undoubtedly the most northern central peak. It is this last that has now been measured, and no bright point exists immediately north of it.

d. (Hortensius). The place assigned by Mädler to this formation appears to be certainly nearly a degree too far north, and to be due to an error in reducing the observation that was made. None of the measures on which its position now rests gave a latitude within some half a degree of that assigned by Mädler. The point measured was the centre of the glittering spot that appears to occupy the site of Hortensius in high illuminations. According to Mädler this occupies the exact site of the crater, and this is certainly correct, for four additional measures taken

of the centre of the crater when close to the terminator give the following position :

Hortensius 4 measures $27^{\circ} 45' 22''$ E. Long. $6^{\circ} 0' 46''$ N. Lat.

e. (Kepler). The considerable discrepancy between the two places, though both of the first order, admits of an easy explanation. Of the eleven measures on which the position assigned by Mädler rests, three were made during the very commencement of the work ; and many of the results obtained by Mädler during this period he had to reject as faulty. Now these three measures, though retained by Mädler, are discordant when compared with the other eight, as they place the latitude nearly three-quarters of a degree farther south than the rest do. These three should obviously be rejected, and then the other accordant eight measures give for the place of this point, Kepler, 8 measures, $37^{\circ} 43' 21''$ E. long. ; $7^{\circ} 55' 33''$ N. lat. This result agrees entirely with the position derived from the later measures.

f. (Rosse). This name has been applied, as the point is very well placed for a point of the first order, and requires a special name. The Rosse of Webb has an unsuitable locality on the S.W. quadrant.

This Catalogue has not been delayed until the completion of the work, as this will occupy a considerable period ; and these places being in many cases far more accurate than Mädler's, will be found very useful in selenographical work now proceeding. Moreover further work in this direction has been suspended, pending a thorough examination of the Moon's limb, the irregularities on which exert considerable influence on this work.

Chart of the Apparent Path of Mars, 1877, with Neighbouring Stars.

(Communicated by the Astronomer Royal.)

The accompanying chart has been prepared with a view of facilitating observations for the determination of the Solar parallax, the stars down to the ninth magnitude having been laid down from Bessel's "Catalogus Stellarum in Zonis Regionemontanis" (Weisse's Bessel), applying $+2^m 42^s$ to the R.A., and $-17'$ to the N.P.D. of each star for precession since 1825. The daily positions of *Mars* are, for Greenwich Mean Noon.

The approximate places of the stars are given in the following table :—